Name ....

$\vec{p} = \int \vec{r'} \rho(r') d\tau'$

$\hat{r} = \sin\theta\cos\phi \ \hat{x} + \sin\theta\sin\phi \ \hat{y} + \cos\theta \ \hat{z}$

$\hat{\theta} = \cos\theta\cos\phi \ \hat{x} + \cos\theta\sin\phi \ \hat{y} - \sin\theta \ \hat{z}$

$\hat{\phi} = -\sin\phi \ \hat{x} + \cos\phi \ \hat{y}$

1. Write an integral expression for the dipole moment of a spherical shell of radius R which carries a surface charge $\sigma = k\cos\theta$.

$$\vec{p} = \int \vec{r'} \rho(\vec{r'}) d\tau'$$

$$d\tau' = r'^2 \sin^2\theta' \ d\theta' d\phi' dr'$$

$$\rho(\vec{r'}) = \delta(r'-R) \ \sigma = \delta(r'-R) \ k\cos\theta$$

$$\vec{r'} = |\vec{r'}| \ \hat{r'} = |\vec{r'}| \left(\sin\theta\cos\phi \ \hat{x} + \sin\theta\sin\phi \ \hat{y} + \cos\theta\hat{z}\right)$$

Put it all together with limits

$$r' : \quad 0 \to \infty$$

$$\theta' : \quad 0 \to \pi$$

$$\phi' : \quad 0 \to 2\pi$$